

# OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **Mascoma Lake, Enfield**, the program coordinators have made the following observations and recommendations.

Thank you for your continued hard work sampling the lake this year! Your monitoring group sampled the deep spot **three** times this year and has done so for many years! As you know, conducting multiple sampling events each year enables DES to more accurately detect water quality changes. Keep up the good work!

We encourage your monitoring group to continue utilizing the Colby Sawyer College Water Quality Laboratory in New London. This laboratory was established to serve the large number of lakes/ponds in the greater Lake Sunapee region of the state. This laboratory is inspected by DES and operates under a DES approved quality assurance plan. We encourage your monitoring group to utilize this laboratory next summer for all sampling events, except for the annual DES biologist visit. To find out more about the Colby Sawyer College Water Quality Laboratory, and/or to schedule dates to pick up bottles and equipment, please call Bonnie Lewis, laboratory manager, at (603) 526-3486.

## FIGURE INTERPRETATION

### CHLOROPHYLL-A

- **Figure 1 and Table 1:** Figure 1 in Appendix A depicts the historical and current year chlorophyll-a concentration in the water column. Table 1 in Appendix B lists the minimum, maximum, and mean concentration for each year that the lake has been monitored through VLAP.

Chlorophyll-a, a pigment found in plants, is an indicator of the algal abundance. Algae (also known as phytoplankton) are typically microscopic, chlorophyll producing plants that naturally occur in lake ecosystems. The chlorophyll-a concentration measured in the water gives biologists an estimation of the algal concentration or lake

productivity. **The median summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 4.58 mg/m<sup>3</sup>.**

#### **STATION 1**

The current year data (the top graph) show that the chlorophyll-a concentration **increased** from **June** to **July**, and then **decreased** from **July** to **August**.

The historical data (the bottom graph) show that the **2010** chlorophyll-a mean is **less than** the state and similar lake medians. For more information on the similar lake median, refer to Appendix F.

Overall, the statistical analysis of the historical data (the bottom graph) show that the mean annual chlorophyll-a concentration has **not significantly changed** (neither *increased* nor *decreased*) since monitoring began. Specifically, the chlorophyll-a concentration has remained **relatively stable, ranging between approximately 1.87 and 5.56 mg/m<sup>3</sup>**, since **1991**. Please refer to Appendix E for a detailed statistical analysis explanation and data print-out.

#### **STATION 2**

The current year data (the top graph) show that the chlorophyll-a concentration **increased** from **June** to **July**, and then **decreased** from **July** to **August**.

The historical data (the bottom graph) show that the **2010** chlorophyll-a mean is **less than** the state and similar lake medians, and was the lowest mean chlorophyll-a concentration since monitoring began! For more information on the similar lake median, refer to Appendix F.

Overall, the statistical analysis of the historical data (the bottom graph) show that the mean annual chlorophyll-a concentration has **not significantly changed** (neither *increased* nor *decreased*) since monitoring began. Specifically, the chlorophyll-a concentration has remained **relatively stable, ranging between approximately 2.35 and 6.59 mg/m<sup>3</sup>**, since **1991**. Please refer to Appendix E for a detailed statistical analysis explanation and data print-out.

While algae are naturally present in all lakes and ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes and ponds, phosphorus is the nutrient that algae typically depend upon for growth in New Hampshire lakes. Algal concentrations may increase as nonpoint sources of phosphorus from the watershed increase, or as in-lake phosphorus sources increase. Therefore, it is extremely important for volunteer monitors to continually educate all watershed residents about management

practices that can be implemented to minimize phosphorus loading to surface waters.

## TRANSPARENCY

- **Figure 2 and Tables 3a and 3b:** Figure 2 in Appendix A shows the historical and current year data for transparency with and without the use of a viewscope. Table 3a in Appendix B lists the minimum, maximum and mean transparency data without the use of a viewscope and Table 3b lists the minimum, maximum and mean transparency data with the use of a viewscope for each year that the lake has been monitored through VLAP.

Volunteer monitors use the Secchi disk, a 20 cm disk with alternating black and white quadrants, to measure how far a person can see into the water. Transparency, a measure of water clarity, can be affected by the amount of algae and sediment in the water, as well as the natural lake color of the water. **The median summer transparency for New Hampshire's lakes and ponds is 3.2 meters.**

### STATION 1

The current year data (the top graph) show that the non-viewscope in-lake transparency ***decreased gradually*** from **June** to **August**.

The historical data (the bottom graph) show that the **2010** mean non-viewscope transparency is ***slightly greater than*** the state median and is ***less than*** the similar lake median. Please refer to Appendix F for more information about the similar lake median.

The current year data (the top graph) show that the viewscope in-lake transparency ***increased*** from **June** to **July**, and then ***decreased slightly*** from **July** to **August**. The transparency measured with the viewscope was generally ***greater than*** the transparency measured without the viewscope this summer. A comparison of the transparency readings taken with and without the use of a viewscope shows that the viewscope typically increases the depth to which the Secchi disk can be seen into the lake, particularly on sunny and windy days. We recommend that your group measure Secchi disk transparency with and without the viewscope on each sampling event.

It is important to note that viewscope transparency data are not compared to a New Hampshire median or similar lake median. This is because lake transparency with the use of a viewscope has not been historically measured by DES. At some point in the future, the New Hampshire and similar lake medians for viewscope transparency will be calculated and added to the appropriate graphs.

Overall, the statistical analysis of the historical data shows that the non-viewscope transparency has ***significantly decreased*** (meaning ***worsened***) on average by ***approximately 1.36 percent*** per year during the sampling period **1991 to 2010**. Please refer to Appendix E for the statistical analysis explanation and data print-out.

## **STATION 2**

The current year data (the top graph) show that the non-viewscope in-lake transparency ***increased slightly*** from **June to July**, and then ***remained stable*** from **July to August**.

The historical data (the bottom graph) show that the **2010** mean non-viewscope transparency is ***slightly greater than*** the state median and is ***less than*** the similar lake median. Please refer to Appendix F for more information about the similar lake median.

The current year data (the top graph) show that the viewscope in-lake transparency ***increased*** from **June to July**, and then ***decreased slightly*** from **July to August**. The transparency measured with the viewscope was generally ***greater than*** the transparency measured without the viewscope this summer. A comparison of the transparency readings taken with and without the use of a viewscope shows that the viewscope typically increases the depth to which the Secchi disk can be seen into the lake, particularly on sunny and windy days. We recommend that your group measure Secchi disk transparency with and without the viewscope on each sampling event.

It is important to note that viewscope transparency data are not compared to a New Hampshire median or similar lake median. This is because lake transparency with the use of a viewscope has not been historically measured by DES. At some point in the future, the New Hampshire and similar lake medians for viewscope transparency will be calculated and added to the appropriate graphs.

Overall, the statistical analysis of the historical data shows that the non-viewscope transparency has ***significantly decreased*** (meaning ***worsened***) on average by ***approximately 1.62 percent*** per year during the sampling period **1991 to 2010**. Please refer to Appendix E for the statistical analysis explanation and data print-out.

Typically, high intensity rainfall causes sediment-laden stormwater runoff to flow into surface waters, thus increasing turbidity and decreasing clarity. Efforts to stabilize stream banks, lake and pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake or pond should continue on an annual basis. Guides to best

management practices that can be implemented to reduce, and possibly even eliminate, nonpoint source pollutants, are available from DES upon request.

## TOTAL PHOSPHORUS

- **Figure 3 and Table 8:** The graphs in Figure 3 in Appendix A show the amount of epilimnetic (upper layer) phosphorus and hypolimnetic (lower layer) phosphorus; the inset graphs show current year data. Table 8 in Appendix B lists the annual minimum, maximum, and median concentration for each deep spot layer and each tributary since the lake has been sampled through VLAP.

Phosphorus is typically the limiting nutrient for vascular aquatic plant and algae growth in New Hampshire's lakes and ponds. Excessive phosphorus in a lake or pond can lead to increased plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 12 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

### STATION 1

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration ***increased slightly*** from **June** to **July**, and then ***decreased*** from **July** to **August**.

The historical data show that the **2010** mean epilimnetic phosphorus concentration is ***slightly less than*** the state median and is ***slightly greater than*** the similar lake median. Refer to Appendix F for more information about the similar lake median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration ***increased gradually*** from **June** to **August**.

The hypolimnetic (lower layer) turbidity sample was ***slightly elevated*** on the **July and August** sampling events (**2.04 and 3.12 NTUs**). This suggests that the lake bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling and/or that the lake bottom is covered by an easily disturbed thick organic layer of sediment. When the lake bottom is disturbed, phosphorus rich sediment is released into the water column. When collecting the hypolimnion sample, make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

The historical data show that the **2010** mean hypolimnetic phosphorus concentration is ***slightly greater than*** the state and

similar lake medians. Please refer to Appendix F for more information about the similar lake median.

Overall, the statistical analysis of the historical data shows that the epilimnetic (upper layer) phosphorus concentration has **not significantly changed** (either *increased* or *decreased*) since monitoring began. Specifically, the mean annual epilimnetic phosphorus concentration has remained **relatively stable, ranging between approximately 6 and 15 ug/L** since **1991**. Please refer to Appendix E for the statistical analysis explanation and data print-out.

Overall, the statistical analysis of the historical data shows that the hypolimnetic (lower layer) phosphorus concentration has **not significantly changed** since monitoring began. Specifically, the mean annual hypolimnetic phosphorus concentration has **fluctuated between approximately 11 and 26 ug/L** (excluding 2003 data) since **1991**. Please refer to Appendix E for the detailed statistical analysis explanation and data print-out.

## STATION 2

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration **decreased** from **June** to **July**, and then **increased slightly** from **July** to **August**.

The historical data show that the **2010** mean epilimnetic phosphorus concentration is **slightly less than** the state median and is **slightly greater than** the similar lake median. Refer to Appendix F for more information about the similar lake median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration **increased gradually** from **June** to **August**.

The hypolimnetic (lower layer) turbidity sample was **slightly elevated** on the **August** sampling event (**4.92 NTUs**). This suggests that the lake bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling and/or that the lake bottom is covered by an easily disturbed thick organic layer of sediment. When the lake bottom is disturbed, phosphorus rich sediment is released into the water column. When collecting the hypolimnion sample, make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

The historical data show that the **2010** mean hypolimnetic phosphorus concentration is **slightly less than** the state median and

***slightly greater than*** the similar lake median. Please refer to Appendix F for more information about the similar lake median.

Overall, the statistical analysis of the historical data shows that the epilimnetic (upper layer) and hypolimnetic (lower layer) phosphorus concentration has ***not significantly changed*** (either *increased* or *decreased*) since monitoring began. Specifically, the mean annual epilimnetic and hypolimnetic phosphorus concentration has remained ***relatively stable, ranging between approximately 5 and 18 ug/L*** (excluding 1996 hypolimnetic data) since **1991**. Please refer to Appendix E for the statistical analysis explanation and data print-out.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about the watershed sources of phosphorus and how excessive phosphorus loading can negatively impact the ecology and the recreational, economical, and ecological value of lakes and ponds.

#### TABLE INTERPRETATION

➤ **Table 2: Phytoplankton**

Table 2 in Appendix B lists the current and historical phytoplankton and/or cyanobacteria observed in the lake. Specifically, this table lists the three most dominant phytoplankton and/or cyanobacteria observed in the sample and their relative abundance in the sample.

##### STATION 1

The dominant phytoplankton and/or cyanobacteria observed in the **August** sample were ***Filamentous species (Cyanobacteria)***, ***Coelosphaerium (Cyanobacteria)***, and ***Anabaena (Cyanobacteria)***.

##### STATION 2

The dominant phytoplankton and/or cyanobacteria observed in the **August** sample were ***Coelosphaerium (Cyanobacteria)***, ***Anabaena (Cyanobacteria)***, and ***Tabellaria (Diatom)***.

Phytoplankton populations undergo a natural succession during the growing season. Please refer to the “Biological Monitoring Parameters” section of this report for a more detailed explanation regarding seasonal plankton succession. Diatoms and golden-brown algae populations are typical in New Hampshire’s less productive lakes and ponds.

➤ **Table 2: Cyanobacteria**

A **large amount** of cyanobacteria, in particular *Anabaena*, were observed in the **August** plankton samples. ***These cyanobacteria, if present in large amounts, can be toxic to livestock, wildlife, pets, and humans.*** Please refer to the “Biological Monitoring Parameters” section of this report for a more detailed explanation regarding cyanobacteria.

Cyanobacteria can reach nuisance levels when phosphorus loading from the watershed to surface waters is increased and favorable environmental conditions occur, such as a period of sunny, warm weather.

The presence of cyanobacteria serves as a reminder of the lake’s delicate balance. Watershed residents should continue to act proactively to reduce nutrient loading to the lake by eliminating lawn fertilizer use, keeping the lake shoreline natural, re-vegetating cleared areas within the watershed, and properly maintaining septic systems and roads.

In addition, residents should also observe the lake in September and October during the time of fall turnover (lake mixing) to document any algal blooms that may occur. Cyanobacteria have the ability to regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing can affect their buoyancy and cause them to rise to the surface in high concentrations. Wind and currents tend to “pile” cyanobacteria into scums that accumulate in one section of the lake. If a fall bloom occurs, please collect a sample in any clean jar or bottle and contact the VLAP Coordinator.

➤ **Table 4: pH**

Table 4 in Appendix B presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 6.0 typically limits the growth and reproduction of fish. A pH between 6.0 and 7.0 is ideal for fish. The median pH value for the epilimnion (upper layer) in New Hampshire’s lakes and ponds is **6.6**, which indicates that the state surface waters are slightly acidic. For a more detailed explanation regarding pH, please refer to the “Chemical Monitoring Parameters” section of this report.



The mean pH at the **Station 1** deep spot this year ranged from **6.30** in the hypolimnion to **7.06** in the epilimnion, which means that the hypolimnion is *slightly acidic* and the epilimnion is *approximately neutral*.

The mean pH at the **Station 2** deep spot this year ranged from **6.47** in the hypolimnion to **7.08** in the epilimnion, which means that the hypolimnion is *slightly acidic* and the epilimnion is *approximately neutral*.

It is important to point out that the hypolimnetic (lower layer) pH was *lower (more acidic)* than in the epilimnion (upper layer). This increase in acidity near the lake bottom is likely due to the decomposition of organic matter and the release of acidic by-products into the water column.

➤ **Table 5: Acid Neutralizing Capacity**

Table 5 in Appendix B presents the current year and historical epilimnetic ANC for each year the lake has been monitored through VLAP.

Buffering capacity (ANC) describes the ability of a solution to resist changes in pH by neutralizing the acidic input. The median ANC value for New Hampshire's lakes and ponds is **4.8 mg/L**, which indicates that many lakes and ponds in the state are at least "moderately vulnerable" to acidic inputs. For a more detailed explanation about ANC, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean acid neutralizing capacity (ANC) of the **Station 1** epilimnion (upper layer) was **10.0 mg/L**. The mean ANC of the **Station 2** epilimnion was **9.6 mg/L**. These are *greater than* the state median. In addition, this indicates that the lake is *moderately vulnerable* to acidic inputs.

➤ **Table 6: Conductivity**

Table 6 in Appendix B presents the current and historical conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current, which is determined by the number of negatively charged ions from metals, salts, and minerals in the water column. The median conductivity value for New Hampshire's lakes and ponds is **40.0 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean annual epilimnetic conductivity at the **Station 1** deep spot

this year was **67.9 uMhos/cm**. The mean annual epilimnetic conductivity at the **Station 2** deep spot was **67.5 uMhos/cm**. These are ***slightly greater than*** the state median.

The conductivity in the lake is relatively ***stable***, however remains ***slightly greater than*** the state median. Conductivity levels are also ***elevated*** in **4A Lebanon Brook, Browns Brook, Dulacs Brook, Red Barn Bridge, Knox River Inlet, Rt. 4A Bridge, Sucker Brook, and Shaker Brook**. Typically, elevated conductivity indicates the influence of pollutant sources associated with human activities. These sources include failed or marginally functioning septic systems, agricultural runoff, stormwater runoff, and road runoff which can contain road salt during the spring snow-melt. New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could also contribute to increasing conductivity. In addition, natural sources, such as iron and manganese deposits in bedrock, can influence conductivity.

We recommend that your monitoring group conduct stream surveys and rain event sampling along tributaries with ***elevated*** conductivity to help identify the sources.

*For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at **<http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm>**, or contact the VLAP Coordinator.*

It is possible that de-icing materials applied to nearby roadways during the winter months may be influencing the conductivity in the lake. In New Hampshire, the most commonly used de-icing material is salt (sodium chloride).

Therefore, we recommend that the **epilimnion** and the **tributaries** be sampled for chloride next year. This additional sampling may help us identify what areas of the watershed are contributing to the increasing in-lake conductivity.

*Please note that the DES Limnology Center in Concord is able to conduct chloride analyses, free of charge. As a reminder, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.*

➤ **Table 8: Total Phosphorus**

Table 8 in Appendix B presents the current year and historical total phosphorus data for in-lake and tributary stations. Phosphorus is

the nutrient that limits the ability of algae and aquatic plants to grow and reproduce. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The phosphorus concentrations in **4A Lebanon Brook, Canaan Canoe Launch, Dam Outlet, Dulacs Brook, George Pond Outlet, Knox River Inlet, LaSalette Brook, Red Barn Bridge, Rt. 4A Bridge, Smith Pond Brook, and Sucker Brook** were *relatively low* this year, which is good news. However, we recommend that your monitoring group sample the major tributaries to the lake during snow-melt and periodically during rainstorms to determine if the phosphorus concentration is *elevated* in the tributaries during these times. Typically, the majority of nutrient loading to a lake occurs in the spring during snow-melt and during intense rainstorms that cause soil erosion and surface runoff and within the watershed.

Due to the lack of rainfall in 2010, many lakes and tributaries experienced lower phosphorus levels from decreased stormwater runoff.

*For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at <http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm>, or contact the VLAP Coordinator.*

The total phosphorus concentration was *elevated (25 ug/L)* in **Browns Brook** on the **June** sampling event. Dry weather conditions in 2010 likely contributed to low water flows and potentially concentrated nutrients in the tributary.

The total phosphorus concentration in the **Mascoma River Inlet** was *slightly elevated (21 ug/L)* on the **August** sampling event. The turbidity of the sample was also *slightly elevated (3.27 NTUs)*.

The total phosphorus concentration in **McConnell Rd.** was *slightly elevated (18 and 23 ug/L)* on the **July and August** sampling events. The turbidity of the samples was also *slightly elevated (3.19 and 3.72 NTUs)*.

The total phosphorus concentration in **Patten Bridge** was *slightly elevated (21 ug/L)* on the **August** sampling event. The turbidity of the sample was also *slightly elevated (3.11 NTUs)*.

The total phosphorus concentration in **Shaker Brook** was *slightly elevated (19 ug/L)* on the **July** sampling event. The turbidity of the sample was also *slightly elevated (3.80 NTUs)*.

Dry weather conditions likely contributed to low stream flows causing elevated turbidity levels. When the stream bottom is disturbed, phosphorus rich sediment is released into the water column. When collecting tributary samples, please be sure to sample where the tributary is flowing and where the stream is deep enough to collect a “clean” sample free from organic debris and sediment.

However, if you suspect that erosion is occurring in these areas of the watershed, we recommend that your monitoring group conduct a stream survey and rain event sampling along this tributary. This additional sampling may allow us to determine what is causing the **elevated** levels of turbidity and phosphorus.

*For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at <http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm>, or contact the VLAP Coordinator.*

➤ **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**

Table 9 in Appendix B shows the dissolved oxygen/temperature profile(s) collected during **2010**. Table 10 in Appendix B shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of sufficient amounts of dissolved oxygen in the water column is vital to fish and amphibians and bottom-dwelling organisms. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The dissolved oxygen concentration was **relatively high** at all **Station 1** and **Station 2** deep spot depths sampled at the lake on the **June and July** sampling events. As thermally stratified lakes age, and as the summer progresses, oxygen typically becomes **depleted** in the hypolimnion (lower layer) by bacterial decomposition; as seen on the **August** sampling event at both stations. Specifically, the loss of oxygen in the hypolimnion results primarily from biological organisms using oxygen to break down organic matter, both in the water column and particularly at the bottom of the lake or pond where the water meets the sediment.

The dissolved oxygen concentration was greater than **100 percent** saturation between **0.1** and **3.0** meters at the **Station 2** deep spot on the **July** sampling event. Wave action from wind can dissolve atmospheric oxygen into the upper layers of the water column. Layers of algae can also increase the dissolved oxygen in the water column, since oxygen is a by-product of photosynthesis. Considering

that the depth of sunlight penetration into the water column was approximately **3.80** meters on this sampling event, as shown by the Secchi disk transparency depth, we suspect that an abundance of algae in the epilimnion caused the oxygen super-saturation.

➤ **Table 11: Turbidity**

Table 11 in Appendix B lists the current year and historical data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the “Other Monitoring Parameters” section of this report for a more detailed explanation.

As discussed previously, the **Station 1** hypolimnetic (lower layer) turbidity was *slightly elevated* (**2.04 and 3.12 NTUs**) on the **July and August** sampling events. The **Station 2** hypolimnetic turbidity was also *slightly elevated* (**4.92 NTUs**) on the **August** sampling event. In addition, the hypolimnetic turbidities have been elevated on many sampling events during previous sampling years. This suggests that the lake bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling and/or that the lake bottom is covered by an easily disturbed, thick organic layer of sediment. When the lake bottom is disturbed, phosphorus rich sediment is released into the water column. When collecting the hypolimnion sample, make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

The turbidity of the **Station 1 and Station 2** epilimnion (upper layer) samples was *slightly elevated* (**2.81 and 1.07 NTUs**) on the **June** sampling event. This suggests that a rainstorm may have recently contributed stormwater runoff to the lake and/or an algal bloom had occurred in the lake.

The turbidity in the **Mascoma River Inlet, McConnell Rd., Patten Bridge, Rt. 4A Bridge, and Smith Pond Brook** samples was *slightly elevated* on the **June** sampling event. Dry weather conditions likely contributed to low stream flows. When the stream bottom is disturbed, sediment, which typically contains attached phosphorus, is released into the water column. When collecting tributary samples please sample where there's sufficient stream flow and depth to collect a “clean” sample free from debris and sediment.

The turbidity in the **Browns Brook, Canaan Canoe Launch, Dulacs Brook, George Pond Outlet, Knox River Inlet, Mascoma River Inlet, McConnell Rd., Patten Bridge, and Shaker Brook** samples was *slightly elevated* on the **July** sampling event. Weather records indicate rainfall **24 hours** prior to sampling.

The turbidity in the **Canaan Canoe Launch, Dam Outlet, Mascoma River Inlet, McConnell Rd., and Patten Bridge** samples was **slightly elevated** on the **August** sampling event. Weather records indicate **0.36 inches** of rainfall occurred **24 hours** prior to sampling.

Dry weather conditions likely contributed to low stream flows, and combined with recent rainfall, flushed the tributary systems. This “flushing” can transport sediment and/or organic debris through the tributary system. If you suspect erosion in the watershed, we recommend conducting a stream survey to identify sediment erosion. We also recommend that your monitoring group conduct rain event sampling along this tributary. This additional sampling may allow us to determine what is causing the **elevated** levels of turbidity.

*For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at <http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm>, or contact the VLAP Coordinator.*

➤ **Table 12: Bacteria (*E.coli*)**

Table 12 in Appendix B lists the current year and historical data for bacteria (*E.coli*) testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that sewage **may** be present. If sewage is present in the water, potentially harmful disease-causing organisms **may** also be present.

The **Knox River Inlet** and **Mascoma River Inlet** *E. coli* concentrations were **slightly elevated** on the **August** sampling event. However, the concentrations of **260** and **230** counts per 100 mL **were not greater than** the state standard of 406 counts per 100 mL for recreational waters that are not designated public beaches.

If you are concerned about *E. coli* levels at this station, your monitoring group should conduct rain event sampling and bracket sampling in this area to help us determine the bacteria source.

*For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at <http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm>, or contact the VLAP Coordinator.*

➤ **Table 13: Chloride**

Table 13 in Appendix B lists the current year and the historical data for chloride sampling. The chloride ion (Cl<sup>-</sup>) is found naturally in some surfacewaters and groundwaters and in high concentrations in seawater. Research has shown that elevated chloride levels can be toxic to freshwater aquatic life. In order to protect freshwater aquatic life in New Hampshire, the state has adopted **acute and chronic** chloride criteria of **860 and 230 mg/L** respectively. The chloride content in New Hampshire lakes is naturally low, generally less than 2 mg/L in surface waters located in remote areas away from habitation. Higher values are generally associated with salted highways and, to a lesser extent, with septic inputs. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

Chloride sampling was **not** conducted during **2010**.

➤ **Table 14: Current Year Biological and Chemical Raw Data**

Table 14 in Appendix B lists the most current sampling year results. Since the maximum, minimum, and annual mean values for each parameter are not shown on this table, this table displays the current year “raw,” meaning unprocessed, data. The results are sorted by station, depth, and then parameter.

➤ **Table 15: Station Table**

As of the spring of 2004, all historical and current year VLAP data are included in the DES Environmental Monitoring Database (EMD). To facilitate the transfer of VLAP data into the EMD, a new station identification system had to be developed. While volunteer monitoring groups can still use the sampling station names that they have used in the past and are most familiar with, an EMD station name also exists for each VLAP sampling location. Table 15 in Appendix B identifies what EMD station name corresponds to the station names you have used in the past and will continue to use in the future.

## **DATA QUALITY ASSURANCE AND CONTROL**

### **Annual Assessment Audit:**

During the annual visit to your lake, the biologist conducted a sampling procedures assessment audit for your monitoring group. Specifically, the biologist observed the performance of your monitoring group and completed an assessment audit sheet to document the volunteer monitors’ ability to follow the proper field sampling procedures, as

outlined in the VLAP Monitor's Field Manual. This assessment is used to identify any aspects of sample collection in which volunteer monitors failed to follow proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure samples that the volunteer monitors collect are truly representative of actual lake and tributary conditions.

Overall, your monitoring group did an **excellent** job collecting samples on the annual biologist visit this year! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the biologist to provide additional training. Keep up the good work!

### **Sample Receipt Checklist:**

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if your group followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did an **excellent** job when collecting samples and submitting them to the laboratory this year! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the laboratory staff to contact your group with questions, and no samples were rejected for analysis.

### **USEFUL RESOURCES**

*Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials*, DES Booklet WD-03-42, (603) 271-2975 or

[www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-03-42.pdf](http://www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-03-42.pdf).

*Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms*, DES fact sheet WMB-10, (603) 271-2975 or

[www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-10.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-10.pdf).

*How to Identify Cyanobacteria*, DES Pamphlets & Brochures, (603) 271-2975 or

[http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/cyano\\_id\\_flyer.pdf](http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/cyano_id_flyer.pdf)



*Iron Bacteria in Surface Water*, DES fact sheet WD-BB-18, (603) 271-2975 or  
<http://des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb-18.pdf>.

*Low Impact Development Hydrologic Analysis*. Manual prepared by Prince George's County, Maryland, Department of Environmental Resources. July 1999. To access this document, visit [www.epa.gov/owow/nps/lid\\_hydr.pdf](http://www.epa.gov/owow/nps/lid_hydr.pdf) or call the EPA Water Resource Center at (202) 566-1736.

*Low Impact Development: Taking Steps to Protect New Hampshire's Surface Waters*, DES fact sheet WD-WMB-17, (603) 271-2975 or  
[www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-17.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-17.pdf).

*NH Stormwater Management Manual Volume 1: Stormwater and Antidegradation*, DES fact sheet WD-08-20A, (603) 271-2975 or  
<http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20a.pdf>

*NH Stormwater Management Manual Volume 2: Post-Construction Best Management Practices Selection and Design*, DES fact sheet WD-08-20B, (603) 271-2975 or  
<http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20b.pdf>

*NH Stormwater Management Manual Volume 3: Erosion and Sediment Controls During Construction*, DES fact sheet WD-08-20C, (603) 271-2975 or  
<http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20c.pdf>

*Proper Lawn Care In the Protected Shoreland, The Comprehensive Shoreland Protection Act*, DES fact sheet WD-SP-2, (603) 271-2975 or  
<http://des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-2.pdf>.

*Road Salt and Water Quality*, DES fact sheet WD-WMB-4, (603) 271-2975 or  
[www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf).